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Technical Memorandum Baseline Risk Assessment for Operable Unit 10-06, Radionuclide-Contaminated Soils Remedial Investigation/Feasibility Study (Draft)

EG&G Idaho

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(Draft)

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ACRONYMS AND ABBREVIATIONS

ANL-W	Argonne National Laboratory-West
ARA	Auxiliary Reactor Area
BORAX	Boiling Water Reactor Experiment
BRA	baseline risk assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CoPC	contaminants of potential concern
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy, Idaho Operations Office
EBR-I	Experimental Breeder Reactor-I
EPA	U.S. Environmental Protection Agency
ICPP	Idaho Chemical Processing Plant
INEL	Idaho National Engineering Laboratory
IDHW	Idaho Department of Health and Welfare
LCCDA	Liquid Corrosive Chemical Disposal Area
LOFT	Loss-of-Fluid Test Facility
NRF	Naval Reactors Facility
OU	operable unit
PBF	Power Burst Facility
QAPjP	quality assurance project plan
RCS	radionuclide-contaminated soil
RESL	Radiological and Environmental Sciences Laboratory
RM&D	EG&G Radiation, Measurements, and Development Unit
RWMC	Radioactive Waste Management Complex
TAN	Test Area North
TRA	Test Reactor Area
TSF	Technical Support Facility
UCL	upper confidence limit
WERF	Waste Experimental Reduction Facility

Technical Memorandum
Baseline Risk Assessment for Operable Unit 10-06, Radionuclide-Contaminated Soils Remedial Investigation/Feasibility Study (Draft)

1. INTRODUCTION

1.1 Purpose and Scope of Memorandum

Operable Unit (OU) 10-06 is being investigated as a remedial investigation/feasibility study (RI/FS) under the Idaho National Engineering Laboratory (INEL) Federal Facilities Agreement and Consent Order and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Both CERCLA and the National Oil and Hazardous Substance Contingency Plan require federal agencies to conduct baseline risk assessments (BRAs) on past releases as part of the RI/FS process. This technical memorandum supports the BRA that will be part of the OU 10-06 radionuclide-contaminated soils (RCS) RI/FS. BRAs conducted according to CERCLA typically consist of the components shown in Figure 1 (EPA 1989a). The approach to the OU 10-06 BRA will follow the guidance as indicated in Figure 1 unless otherwise documented herein or in the appendices.

The body of this technical memorandum presents BRA issues unique to OU 10-06, states why they are issues, presents the current proposal for addressing the issues, and presents all of the information available to date on conducting the BRA. The issues presented have been discussed during conference calls and scoping meetings among the U.S. Department of Energy, Idaho Operations Office (DOE-ID), U.S. Environmental Protection Agency (EPA) Region 10, and the State of Idaho Department of Health and Welfare (IDHW). The BRA will be included in the Remedial Investigation report and will provide essential information for the remedial project manager's decisionmaking process. This memorandum is not intended to be a primer for all aspects of the BRA process. The topics presented in this memorandum are site-specific issues for OU 10-06 related to the potential contaminants of concern, information obtained from radiological surveys and soil samples, estimation of risk from field dose measurements, and future exposure scenarios. The approaches presented herein may change pending evaluation of the data.

Appendices will be attached to this technical memorandum at a later date to provide specific information about the calculation of background concentrations (Appendix A). The draft runs (Appendices B and C) of two risk assessments for sites within OU 10-06 focus on unique features of the risk assessment. The two sites chosen for these appendices are the windblown area around the Loss-of-Fluid Test (LOFT) facility (Appendix B) and the Argonne National Laboratory-West (ANL-W) stockpile of radionuclide-contaminated soil from the ANL-W interceptor canal (Appendix C). These preliminary examples provide additional information that is not presented in the body of this technical memorandum. This technical memorandum, although not a primary document, is an interim deliverable for the remedial investigation and focused feasibility study for OU 10-06 and will be submitted to DOE-ID, EPA Region 10, and IDHW for their reviews.

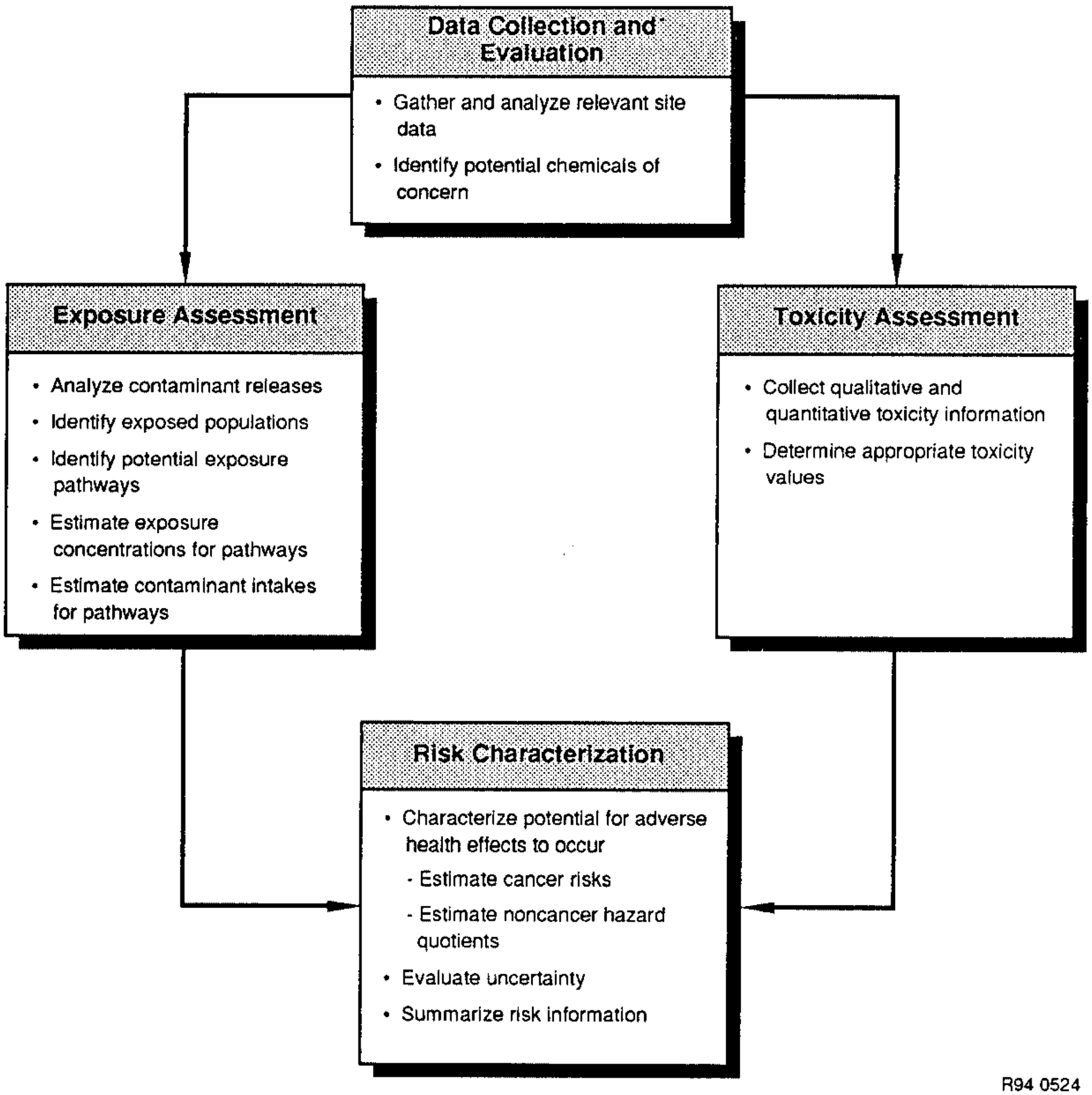

Figure 1. Components of a Baseline Risk Assessment.

1.2 Operable Unit Description

OU 10-06 includes areas of windblown contamination and specific sites (i.e., non-windblown) from other INEL OUs where radionuclides are suspected as the primary risk driver. The criterion for including an area in OU 10-06 Radionuclide Contaminated Soils is the presence of 2 radionuclide-contaminated soils where the radiological contaminant, known or expected, is the presumed primary risk driver. The "Final Statement of Work for Operable Unit 10-06 Radionuclide-Contaminated Soils Remedial Investigation/Feasibility Study" (EG&G 1993a) present a flow chart documenting the inclusion criteria for sites in OU 10-06. Although hazardous constituents may be present at some of the sites to be investigated as part of this OU, information obtained to date and past risk assessment experience indicate that the radionuclides will be the major contributor to risk. Unless new information indicates either that the hazardous constituents are in higher concentrations than originally thought or that very toxic hazardous constituents are present, radionuclides will be presumed to be the major risk contributor.

Windblown sites are those that are located outside the fences or controlled areas of individual facilities of the INEL. The windblown sites contain contamination composed entirely of radionuclides that may have been a result of airborne deposition as a result of operations at these facilities:

- Argonne National Laboratory-West (ANL-W)
- Auxiliary Reactor Area (ARA)
- Boiling Water Reactor Experiment (BORAX)
- Central Facilities Area (CFA)
- Experimental Breeder Reactor No. 1 (EBR-I)
- Idaho Chemical Processing Plant (ICPP)
- Power Burst Facility (PBF)
- Radioactive Waste Management Complex (RWMC)
- Test Area North (TAN), including the Loss-of-Fluid-Test (LOFT) and the Test Support Facility (TSF)
- Test Reactor Area (TRA).

The non-windblown sites are a group of sites generally within INEL facility boundaries where the contamination resulted from spills, discharges, and, in some cases, windblown deposition of contaminants that consist of radionuclides, metals, and/or organic compounds. Both windblown and non-windblown sites are listed in Table 1.

Table 1. Radionuclide-contaminated sites that compose OU 10-06.

WAG	Site number	Site name
1	TSF-06	TSF TAN/TSF-1 Area (Soil Area)
1	TSF-29	TSF Acid Pond
2	TRA-34	TRA North Storage Area
5	PBF-22	PBF SPERT IV Leach Pond
6	BORAX-08	BORAX Ditch
6	BORAX-01	BORAX II-V Leach Pond
6	EBR-15	Radioactive Soil Contamination
9		Stockpile of radionuclide-contaminated soils from ANL-W interceptor canal
10	LCCDA-01 and LCCDA-02	Liquid Corrosive Chemical Disposal Area (LCCDA)
10		Windblown contamination (outside facility boundaries and within aerial isopleths)

2. DATA COLLECTION AND EVALUATION

Data that presently exist for the windblown sites include data collected by the U.S. Department of Energy (DOE) Radiological and Environmental Sciences Laboratory (RESL) from 1971 to present and the Phase I sampling that was performed in the summer of 1993. Some of the non-windblown sites have limited data and are being sampled in the spring of 1994. This section discusses existing data; data collection, evaluation and usability; determination of background concentrations of radionuclides and metals; calculation of the concentration term; contaminants of potential concern; extent of contamination; and uncertainty analysis.

2.1 Existing Data

2.1.1 RESL Data

In the early 1970s, RESL established a routine monitoring program for radionuclides in surface soils outside the fences of the INEL facilities and at offsite locations to detect changes in radioactivity resulting from INEL operations. Extensive sampling grids were established outside the facility fences in areas known or believed to be capable of releasing radionuclides that could lead to surface contamination. Other facilities were simply encircled with sample locations outside facility fences. Table 2 shows the INEL facility, years sampled, and number of samples collected at locations inside the INEL. Soils in the vicinity of the RWMC, ICPP, TRA, and ARA were extensively sampled between 1970 and 1977. In 1976, a rotating 7-yr schedule for sampling all INEL facilities was established.

Data collected by RESL have been used for monitoring purposes and are not specifically collected for compliance with CERCLA quality assurance/quality control guidance. However, data were collected using standard practices, and, starting in the late 1970s, some of the samples were archived and are now available for reanalysis.

Offsite RESL soil sampling efforts were intended to provide baseline radioactivity in regional soils so changes in the amount of radioactivity onsite could be identified. These data can be used to determine background concentrations of radionuclides (see Section 2.3). The offsite sampling locations are shown in Figure 2. Offsite sampling locations were sampled in even-numbered years beginning in 1972.

2.1.2 Aerial Isopleths

An aerial survey was conducted from June 6 through August 3, 1990, by EG&G Energy Measurements, Inc., and the isopleths are presented in the *Sampling and Analysis Plan for Phase I of the Operable Unit 10-06 Radionuclide-Contaminated Soils Remedial Investigation/Feasibility Study* (EG&G Idaho 1993b). These isopleths were used for initially bounding the extent of contamination in an effort to determine sampling locations for the windblown sites. The general boundaries of the windblown sites are outside the facility fences and within the outermost aerial survey isopleths.

Table 2. Historical RESL schedule for sampling onsite surface soils. (EG&G 1994a)

Year	Facility	Number of Samples
1971	ICPP	3
1972	RWMC	7
1973	RWMC	28
1973	ICPP	19
1974	RWMC	35
1976	ICPP	34
1976	LOFT	18
1976	TRA	87
1976	CFA	3
1977	ARA	59
1977	PBF	22
1978	EBR-I	12
1978	BORAX	8
1978	RWMC	37
1979	ANL-W	42
1980	Naval Reactor Facility (NRF)	36
1981	TAN	37
1982	ICPP	64
1982	Waste Experimental Reduction Facility (WERF)	5
1983	TRA	32
1985	RWMC	50
1985	PBF	22
1985	ARA	64
1986	ANL-W	36
1987	NRF	22
1987	ICPP	56
1988	TAN	38
1989	ICPP	60
1989	WERF	10
1990	TRA	42
1991	ARA	16
1992	PBF	22

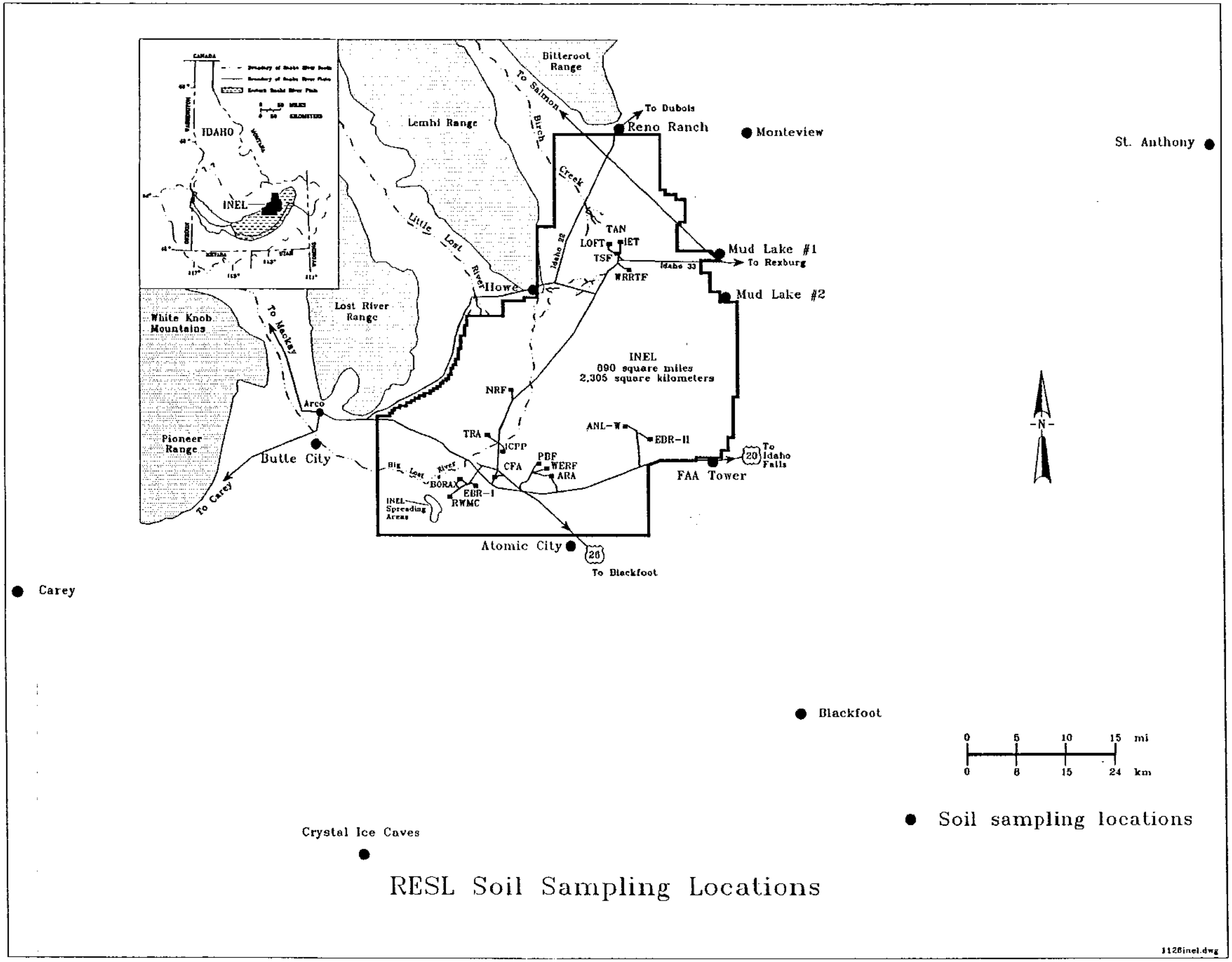

Figure 2. Offsite RESL sampling locations.

The aerial survey was conducted using sensitive instrumentation to detect gamma radiation from land sources. Although many areas of gamma radiation were noted, many of the sources can be attributed to gamma photons emitted from operating facilities. Direct radiation surveys using hand-held or truck-mounted instruments have also been conducted to identify areas where radioactivity levels are higher than the regional background. Direct radiation surveys are influenced by radiation from operating facilities as well as by radioactivity from surface soils. Only direct radiation surveys, using hand-held or truck mounted instruments, can identify alpha- or beta-emitting radionuclides, respectively.

2.2 Data Collection

2.2.1 OU 10-06 Phase I Sampling

The 1993 OU 10-06 Phase I sampling effort was conducted in the summer of 1993 and was designed as a preliminary investigation of the windblown sites. The Phase I sampling strategy, including specific areas of sample collection and rationale for sampling and analysis, can be found in the *Sampling and Analysis Plan for Phase I of the Operable Unit 10-06 Radionuclide-Contaminated Soils Remedial Investigation/Feasibility Study* (EG&G 1993c). All of the Phase I data have been validated.

All samples collected during Phase I sampling were analyzed for gamma-emitting radionuclides by gamma spectroscopy. Approximately 10% of the samples were also analyzed for strontium-90 (Sr-90), plutonium-238 (Pu-238)/americium-241 (Am-241), Pu-239/240, and uranium-234 (U-234), -235, and -238. The number of samples chosen for a specific analysis roughly corresponds with the ratio of the various analytes (i.e., gamma radionuclides, transuranic radionuclides, and Sr-90) detected during the RESL sampling. These radionuclides have been associated with nuclear activities at the INEL, and were, therefore, the logical targets for analyses. Samples were collected from 0 to 4 in. (0 to 10.2 cm) deep for comparison to existing data collected by RESL and because the RESL data collected at depth indicate that windblown-deposited radionuclides are restricted to the top few inches of soil.

In addition, fifty-seven samples archived by RESL were reanalyzed by gamma spectroscopy for gamma-emitting radionuclides. The samples for reanalysis were chosen in a biased fashion to include samples with some of the highest detections in each of the windblown areas. This approach was taken to ensure that the samples chosen for reanalysis would be those that contained measurable concentrations of radionuclides. All samples were analyzed by current methods used by the EG&G Radiation, Measurements, and Development Unit (RM&D), which also analyzed the samples collected during the Phase I field activities. Reanalyzing of the 57 RESL samples allowed for comparison between the OU 10-06 results and previous RESL sampling results. Radioactive decay was accounted for when the analytical results were compared. Ten RESL samples were also reanalyzed for Sr-90, and nine samples were reanalyzed for (Pu-238)/(Am-241), Pu-239/240, and U-234, U-235, and U-238 (because in the 57 samples, ten had detections of these compounds when analyzed initially).

A review and evaluation of the RESL data, which will aid in determining the usability of these data for CERCLA decisionmaking, are presented in the report *Compilation and Evaluation* *of INEL Radiological and Environmental Sciences Laboratory Surface Soil Sample Data for Use in Operable Unit 10-06 Baseline Risk Assessment* (EG&G 1994a). This report concludes that the comparative analysis of the reanalysis of the archived samples to the original analysis was favorable and the data are usable for risk assessments.

2.2.2 OU 10-06 Phase II Sampling

Additional data on the non-windblown sites and on the TRA windblown area are being collected during the spring of 1994 to complete the site characterization activities for OU 10-06. The Phase II sampling strategy, including specific areas of sample collection and rationale for sampling and analysis, can be found in the *Sampling and Analysis Plan for Phase II of the Operable Unit 10-06 Radionuclide-Contaminated Soils Remedial Investigation/Feasibility Study* (EG&G 1994b).

The collection of field dose measurements is not identified in the sampling and analysis plan. These measurements will be collected at select RESL sample locations and at each of the Phase I and II sampling locations and at approximately 50-ft (15-m) intervals along each of the transects at the windblown sites. Select RESL sampling locations are those on the outer perimeter of their sampling grid and their location was surveyed using a global positioning system. Field dose measurements will be collected at 3 ft (1 m) above the ground surface to represent the dose a person standing at the site would actually receive. These data will be used to support risk calculations for the external exposure pathway for windblown sites. A more detailed discussion of the use of dose measurements in lieu of EPA slope factors is presented in Section 3.3.

2.2.3 Waste Area Groups 3/10 Treatability Study

Soil samples were collected from several sites within OU 10-06. These locations are the PBF Special Power Excursion Reactor Test IV Leach Pond, the BORAX ditch, and radionuclide-contaminated soil at EBR-I. Soil samples were analyzed for alpha-, beta-, and gamma-emitting radionuclides and for particle size. Samples collected to support the treatability study will be evaluated for use in the BRA.

2.3 Background Radionuclides and Metals

Determining background concentrations of metals and radionuclides is an important step in identifying contaminants of potential concern (CoPCs) for the risk assessment. EPA guidance (EPA 1989a) indicates that compounds detected within the range of background can be screened from the risk assessment by using standard statistical calculations and comparisons (see Section 2.5 for a more complete discussion on the use of background). Appendix A will present the background values for radionuclides, metals, and dose for use in the OU 10-06 BRA in addition to the approach used to calculate these values.

Background levels of natural and world-wide fallout radioactivity in surface soils and an assessment of potential buildup of radioactivity from INEL operations have been monitored by RESL sampling. Although much of the surface rock on the Snake River Plain is basalt, the local soil is largely derived from silicic volcanics, which have higher uranium and thorium concentrations than basalt does. As stated previously, all RESL soil samples collected offsite were analyzed for Sr-90 and alpha- and gamma-emitting radionuclides. Concentrations for offsite soil are presented in Table 3 (DOE-ID 1993). Average concentrations (in pCi/g) for the 1992 boundary group (located within a few miles of the INEL) were not statistically greater than the distant-group (located outside the INEL boundaries but many miles distant) concentrations for any radionuclide. INEL operations did not contribute to any of offsite locations. This comparison made by RESL indicates that all of the samples collected offsite can be used as background samples.

In addition to radionuclides, the *Preliminary Assessment of Surface Soils at Active EG&G Idaho Facilities* document (EG&G 1992b) data sets contain background data on metals in soils. The metals data will be given the same statistical treatment as the radionuclide data sets. Those sites within OU 10-06 having sample concentrations of individual metals and/or radionuclides within the range of background for the soil type (if indeed soil types represent different background populations) (including the windblown areas for radionuclides) will not be used in the risk assessment.

In 1989, surface soils at several active EG&G Idaho facilities were sampled to establish baseline concentrations of various metals (EG&G 1992b). Soil samples were collected from three different soil types. Comparing these baseline samples to actual offsite background locations indicates that, with a few exceptions, the elemental concentrations are similar to background and facility soils.

Background concentrations of metals and radionuclides in soils applicable to OU 10-06 sites will be considered during the OU 10-06 BRA. Different soil types are known to contain different concentrations of radionuclides and metals. Fine-grained soils usually contain higher concentrations of metals and radionuclides than coarse-grained or sandy soils. In the case of radionuclides, this affects not only the soil concentration but the radiation field attributed to the radionuclide concentrations. Closely packed fine soils offer more shielding of radiation than sandy soils (EPA 1993a). Different soil types will be found in several of the sites within OU 10-06; therefore, it is possible that there could be different ranges of background data. Other background data collected onsite in undisturbed areas are available for inclusion in the background data set. These include, among others, background samples collected during characterization activities for the New Production Reactor (collected in 1991), from OU 10-06 Phase I sampling (collected in 1993), the *Preliminary Assessment of Surface Soils at Active EG&G Idaho Facilities Data Document* (EG&G 1992b), and from background samples collected from the Naval Ordnance Disposal Area (NODA) (collected in 1993). These data sets will be evaluated for comparability with offsite background samples.

In addition to determining background for radionuclides and metals in the soil, the data on the dose at background locations around the INEL will be evaluated for comparison to the field dose measurements being collected during Phase II sampling.

If the different background data sets (both onsite and offsite) are from the same population, then combining them into the large data set will increase the number of soil types and the number of samples that will be included in the background data set, thus reducing the uncertainty

Table 3. Concentrations of radionuclides for offsite soil. (DOE-ID 1993).

Nuclide	Geometric mean Year	pCi/g	Uncertainty
Cs-137	1990	0.73	0.54–0.99
	1992	0.78	0.56–1.09
Sr-90	1990	0.30	0.22–0.40
	1992	NA[a]	
Pu-238	1990	0.0006	0.0003–0.0012
	1992	0.0013	0.0009–0.0019
Pu-239/240	1990	0.024	0.017–0.035
	1992	0.021	0.013–0.033
Am-241	1990	0.005	0.003–0.008
	1992	0.004	0.002–0.006

a. NA = not available.

in the data. The uncertainty will be reduced because, in general, as you increase the number of samples from a population the standard error of the estimated mean decreases. However, uncertainty cannot be reduced to zero because of natural variability in radiation background and uncertainty inherent in analytical processes.

Each data set will be statistically evaluated by a test of means using the students "t" test. This type of test will determine with a certain degree of confidence (95% will be used in this case) that the sample population from each data set is or is not from the same general background population. Similarity of background sample populations will allow combination of these data sets to form one background sample population with a larger number of samples. From this combined background data set, other statistics such as confidence intervals and tolerance limits can be calculated. It can be established using the "t" test to determine if the background population and sample population from the potentially contaminated areas have the same distribution of concentrations or greater concentrations.

Individual sample points can be compared to in upper tolerance limit to help assess if they exceed background. The upper range of background will be established using the following formula:

$$U_t = \bar{x} + Ks$$

where

U_t = upper tolerance limit

$\bar{x}$ = mean

K = a tabled value [e.g., from the table in Gilbert (1987)]

s = standard deviation.

In addition to the data set comparisons of the "t" test, individual sample concentrations will be compared to the calculated upper tolerance limit of the background. The upper 95% tolerance limit, with 95% confidence, will be calculated and used in the comparison. If a sample falls below the calculated value for the 95% tolerance limit with 95% confidence, then the sample will be assumed to be within the range of background. The "t" distribution and tolerance test assumes the population from which the sample statistic is drawn is normally distributed. If the data are not normally distributed, data transformations to normality will be implemented; alternatively non-parametric methods will be used.

2.4 OU 10-06 Phase I and II Data Evaluation and Usability

The Quality Assurance Project Plan for Waste Area Groups 1, 2, 4, 5, 6, and 10 (EG&G 1993c) requires that the data generated from the OU 10-06 Phase I and Phase II investigations meet or exceed the minimum requirements for the following data quality indicators: precision, accuracy, representativeness, completeness, and comparability before the data can be used in a risk assessment. The following is a description of each data quality indicator. The minimum requirements and goals set for these quality indicators will be compared to the data evaluated in Appendices B and C; the consequences or corrective actions will also be explained in Appendices B and C.

If performance objectives have not been met, additional samples may be required, or the performance parameters may be changed. If a performance parameter is changed, it should be the one that will increase the probability of taking unnecessary actions as opposed to accepting unnecessary risk. As a result, the confidence level would be reduced first, then the minimum detectable difference, and the level of power would be reduced last.

2.4.1 Precision and Accuracy

Minimum requirements for precision as established for risk assessment are:

Confidence level (1- false positive rate): 80% minimum
Power (1- false negative rate): 90% minimum
Minimum detectable difference (ability to detect differences between site samples and background): 10% to 20% (EPA 1990)

The false positive rate is the probability that the null hypothesis is rejected when it is actually true. The false negative rate is the probability that the null hypothesis is accepted when it is actually false. This is important information for risk managers when they are making decisions to take an action or when making a no-action recommendation. As a general rule of thumb, as the confidence level decreases the power increases.

Table 4 presents the results of calculating the confidence in the ability to detect a difference between populations based on the precision goal for the transect data for windblown sites where there was both biased and transect data and biased samples results when only these were collected at a site. Two precision goals were used (i.e., 1 and 5 pCi/g). As can be seen from these data, there is high confidence that these precision goals have been met. This table is based on the Phase I data only, and it is anticipated that the addition of the RESL data will further increase the confidence in the mean. Data in this table were calculated by pooling all the Phase I data from the sites instead of looking at any differences between transects. At this time, this provides a good indication of the confidence in the true mean, but upon further investigation during the BRA, this approach may change.

For the OU 10-06 data, both laboratory and field measurement error (as it applies to precision) is measured using the results of field duplicate analysis. The formula for computing the relative percent difference (RPD) between duplicates is:

$$RPD = \frac{R1 - R2}{(R1 + R2)/2} \times 100$$

where

R1 = results of the first duplicate analysis

R2 = results of the second duplicate analysis

Accuracy measures the bias in a measurement system, and it is difficult to measure for the entire data collection activity. Accuracy is estimated for the laboratory analytical procedures by computing the percent recovery for the spiked compounds as follows:

$$\text{Percent Recovery} = \frac{\text{measured amount}}{\text{amount spiked}} \times 100$$

If the percent recovery in a spiked sample were outside control limits, the data would be labeled with a data quality flag and may result in an unusable data point.

Laboratory blank contamination could result in false positive detections.

Table 4. Confidence in ability to detect a difference between populations.

Site	Precision goal (pCi/g)	Confidence level (%)
ANL-W	1	99.93
	5	>99.99
ARA	1	75.41
	5	99.45
BORAX	1	99.45
	5	>99.99
CFA	1	>99.99
	5	>99.99
EBR-1	1	99.99
	5	>99.99
ICPP	1	71.18
	5	>99.99
LOFT	1	>99.99
	5	>99.99
PBF	1	>99.99
	5	>99.99
RWMC	1	>99.99
	5	>99.99
TREAT	1	99.99
	5	>99.99
TSF	1	>99.99
	5	>99.99
WERF	1	>99.99
	5	>99.99

2.4.2 Representativeness

The quality assurance project plan (QAPjP—EG&G 1993c) states that representativeness is often a qualitative parameter and "is best satisfied by confirming that sampling locations are selected properly and a sufficient number of samples are collected to meet the confidence level required by the intended user of the data." Section 2.7 presents the approach that will be used to determine the area represented by each sampling location. Representativeness also supports data usability because if the data are not representative of site conditions; then, their usability in a BRA is limited. Random sampling, and systematic sampling, provide representative samples.

2.4.3 Completeness

Completeness will be calculated according to Section 8.3 of the QAPjP (EG&G 1993c). Completeness calculations represent a comparison of the number of samples collected for which usable data were generated to the number of samples planned. Usable data are considered data not flagged with a "R" data qualifier. A "R" data flag indicates that the data should be rejected. A "U" flag, indicating a nondetection, is considered usable data because the data point is used at half the detection limit for the BRA for nonradionuclides where there was at least one detection of an analyte and "J" data flag indicating an estimated value is also considered useable for in a BRA. Use of data with a "J" data flag in the BRA will be evaluated qualitatively in the uncertainty section of the BRA. The Phase I sampling and analysis plan (EG&G 1993c) stated a completeness goal for this project of 90%.

2.4.4 Comparability

The objective of the qualitative comparability parameter, as stated in the QAPjP (EG&G 1993d), is the confidence with which one data set can be compared to another. This is achieved by using standard methods for collecting and analyzing the samples, and analytical results are reported in standard units. This is strictly a qualitative measure of determining if standard methods for collecting and analyzing data are the same, or nearly the same, to justify the use of all data in the risk assessment.

The minimum requirement for sampling design comparability is an unbiased sampling design or documented reasons for selecting another design (EPA 1990).

Some of the soil samples collected during the RESL monitoring program have been archived. A set of these samples (57 soil samples) was reanalyzed by the RM&D using techniques that have consistently produced data that have been usable in risk assessments at the INEL. Other indicators for data usability and comparability , such as the use of standardized methods; acceptable limits of detection; traceable standards; background counts; chain of custody procedures; and participation in interlaboratory standards analysis indicate that the data produced by the RESL soil monitoring program are usable for risk assessment purposes (EG&G 1994a).

To further aid in comparing RESL data to Phase I data, all results will be delayed to September 30, 1994. In addition, the two data sets will be analyzed to see if they are from the same population and hence, the data can be pooled. Because of the release from ICPP in 1992 it is possible that the RESL (collected before 1992) and Phase I (collected in 1993) data may be two different populations. In this case, the Phase I data will be used.

2.4.5 Usability

Data that are available from Track 2 sampling efforts should be acceptable for input into the risk assessment. Track 2 data will need to be examined on a case-by-case basis to determine if they meet the minimum criteria for usability in a risk assessment. Generally, the data produced from Track 2 investigations have been of high quality.

Data from Track 1 documents may be usable if some sampling occurred in the past or if process knowledge is well documented and concentrations of contaminants can be determined with a good degree of accuracy. Again this will be on a case-by-case basis.

Analytical quality levels, as determined by the data quality objectives developed during the scoping of the remedial investigation/feasibility study, for both Phase I and II sampling can be found in the sampling and analysis plans (EG&G 1993c, EG&G 1994b). The sampling designs of the RESL and Phase I activities could have an impact on their usability in the BRA. Uncertainty caused by the sampling design will be addressed in the uncertainty section of the BRA.

It should be noted that many of the windblown sites contain very low concentrations of radionuclides that may fall within the range of background. As the acceptable tolerable difference (i.e., the ability to detect differences between contaminated areas and background) increases, the number of samples needed to achieve the statistical confidence to detect that difference decreases. Therefore, the adequacy of characterization and extent of contamination can be determined only after the data from the background and each site-specific data set are statistically evaluated.

2.5 Calculating the Concentration Term

The concentration term is the concentration by environmental media (i.e., soil, water, air) that is used in risk calculations to estimate the contaminant intake for an individual. A generalized intake equation is:

$$I = C \times \frac{IR \times EFD}{BW} \times \frac{1}{AT}$$

where

I	=	intake (i.e., the quantitative measure of exposure)
C	=	contaminant concentration in environmental media (i.e., concentration term)
IR	=	intake rate
EFD	=	exposure frequency and duration
BW	=	body weight
AT	=	averaging time.

The RESL, Phase I and Phase II analytical results will be used to calculate the concentration term. If after performing the initial summary statistics, it is shown that the two data sets (i.e., Phase I and RESL) are not of the same population, then the most current data will be used to calculate the concentration term. For sites at OU 10-06, where risk from exposure to background levels of gamma radiation via the external exposure pathway present a risk greater than the

National Oil and Hazardous Substance Contingency Plan's risk range (i.e., 10^{-06} to 10^{-04}), background soil concentrations in soil for each radionuclide will be subtracted from the concentrations detected in soil samples for each site (i.e., both windblown and nonwindblown). This will allow the BRA to focus on potential risks posed by concentrations of the radionuclides and metals present at the site as a result of site operations. The risk to background concentrations of radionuclides and metals detected at the OU 10-06 sites will also be determined.

For those contaminants where there are no background values, the maximum detected, where EPA-approved toxicity information is available, will be screened by using a risk-based approach as presented in EPA Region 10 Supplemental Guidance (1991). Risk levels for including contaminants into the BRA using the risk-based approach will be, for carcinogenic effects, 10^{-07} and, for noncarcinogenic effects, a hazard quotient of 0.1. This screening approach is necessary because there are several radionuclides that were detected during RESL's monitoring where background values have not been established. Contaminants that are above these values are the CoPCs. Anticipated CoPCs are presented in Section 2.6.

Before the concentration term can be developed, summary statistics will be performed on the data. The W-test (Gilbert 1987) will indicate the type of distribution. In most cases, soil sampling data are lognormally distributed. If the data indicate this, then the data will be transformed by using the natural logarithm function [i.e., calculate ln(x), where x is the value from the data set]. Regardless of the distribution type, the frequency distributions of the data will be plotted to allow for a better understanding of the data distribution at the site. Frequency histograms of the data will be presented in Appendices B and C. Use of frequency histograms graphically displays distributions and adds clarity to the statistical analysis. A table of summary statistics (i.e., number os samples, mean, merdian, maximum, standard deviation, standard error) will be included in the upper confidence limit BRA for each site.

The steps in calculating the concentration term include calculating the 95% upper confidence limit (UCL) of the arithmetic mean (EPA 1992c). This concentration is for the reasonable maximum exposure scenario. If the maximum concentration detected is higher than the UCL, then the maximum concentration will be used as the concentration term. The reasonable maximum exposure for the concentration term is based on the data sets that are considered usable for risk assessment (Section 2.4).

Concentration terms will be developed for use in both the intrusion and nonintrusion scenarios. When calculating the concentration term, samples that have nondetectable concentrations and are to be included in the data set for the BRA will use one-half the detection limit as a surrogate concentration for metals, whereas the actual reported concentration will be used for radionuclides even though they are not "true positive" detections.

All the samples collected by RESL and from the Phase I sampling are either random, systematic, stratified systematic, or biased. RESL created a random sampling grid around certain facilities, they did not establish a random sampling pattern and returned to locations of previous detections for monitoring purposes; this led to a systematic sampling scheme. For a random sampling scheme the area of concern may be chosen purposely, but the location of sampling points within the area may be randomly located. In the case of the transect sampling points for windblown sites, the sampling design is somewhere between a systematic and stratified design.

This is because the transects were located along the prevailing wind directions and the distance between sampling points increased with increased distance from the facility. After the stratification has been taken into account the results will be unbiased.

Although using a random or systematic sampling scheme is preferred for a defensible risk assessment using classical statistics, it is sometimes possible to have a defensible risk assessment when a biased sampling scheme was used by kriging the data. A kriging analysis of the data is not as sensitive to the clustering of samples as that classical statistics. For non-windblown sites where several biased samples were collected, determination of the concentration term will be evaluated on a case-by-case basis.

In some cases, concentration terms are not available for all exposure pathways (e.g., the inhalation pathway). In these cases, the concentration term is modeled and the use of models is described in Section 4.

2.6 Contaminants of Potential Concern

Contaminants of potential concern are determined after screening the concentration term against background and the risk-based soil concentrations as discussed in Section 2.5. It is anticipated that the CoPCs for the windblown sites include: cesium-137 (Cs-137), strontium-90, plutonium-239/240 (Pu-239/240), cobalt-60 (Co-60), Cs-134, Pu-238, uranium-234 (U-234), U-235, U-238 and americium-241. CoPCs for the non-windblown sites are expected to include nonradioactive contaminants and are presented in Table 5. The CoPCs for the nonwindblown sites include some compounds that are based on historical process knowledge and existing data.

2.7 Extent of Contamination

Knowledge of the extent of contamination is necessary to ensure use of a complete and accurate concentration term for use in calculations for the BRA. A preliminary review of the Phase I and RESL data indicates that the concentrations of radionuclides varies significantly within each of the windblown areas. This implies a heterogeneous distribution (i.e., not uniformly higher at the location nearest this facility and decreasing thereafter) over large areas surrounding the facility areas as a result of their deposition by the wind. For the windblown sites, kriging will be performed using GEO-EAS (EPA 1988). Kriging will be used to estimate concentrations of radionuclides at locations where samples were not collected. That is, it interpolates the observed concentrations to estimate unobserved concentrations between sample locations. Kriging was selected for use because it takes into account the spatial correlation of the observations. Kriging will also help estimate the extent of contamination by providing a contour plot of the concentration. A complete discussion on GEO-EAS is presented in Section 4.1.

For non-windblown sites, the extent of contamination will be determined by the results of the Phase II sampling. Soil samples are being collected at locations surrounding the presumed boundary of the sites. If these soil samples indicate no contamination, then the site boundary will be used as the extent of contamination. In those instances where samples that are collected at the edge of the site indicate contamination (above background or risk-based screening values), then the site boundary will be increased by one grid spacing along that edge.

Table 5. Contaminants of potential concern at OU 10-06.

WAG	Site No.	Site name	CoPC
1	TSF-06	TSF-06 soil area	Cs-137, Co-60, Sr-90
1	TSF-29	TSF acid pond	Cs-137, Co-60, Sr-90
2	TRA-34	TRA north storage area	Cadmium, lead, alpha- and gamma-emitting radionuclides, and Sr-90
5	PBF-22	PBF SPERT IV leach pond	Cs-137, Sr-90, Pu-238, Pu-239/240, Am-241, U-234, U-238
6	BORAX-01	BORAX Leach Pond	Cs-137 and nickel
6	BORAX-08	BORAX ditch	Alpha- and gamma-emitting radionuclides, Sr-90, target analyte list for the Contract Laboratory Program metals[a]
6	EBR-15	Radioactive soil contamination	Alpha- and gamma-emitting radionuclides and Sr-90
9	N/A	Stockpile of RCS from ANL interceptor canal	Alpha- and gamma-emitting radionuclides, Sr-90, target analyte list for the Contract Laboratory Program metals[a] and chromium VI
10	LCCDA-01 and LCCDA-02	LCCDA	Cs-137, Sr-90, Pu-238, Pu-239/240, Am-241, U-234, U-238
10	N/A	Windblown areas	Cs-137, Sr-90, Pu-238, Pu-239/240, Am-241, U-234, U-238

a. Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

2.8 Uncertainty Analysis

The BRA calculations will determine potential risks and hazard quotients using default and site-specific exposure parameters. The uncertainty of the parameters and assumptions used in the BRA will be qualitatively evaluated using the standard methods described in the *Risk Assessment Guidance for Superfund: Volume 1 Human Health Evaluation Manual, Part A* (EPA 1989a). Although not planned, a probabilistic risk assessment based on Monte Carlo simulation and employing distributions for exposure parameters may be conducted in situations where the risk managers feel they need more quantitative data than are supplied in the standard qualitative uncertainty analysis. Probabilistic risk assessments need to be performed after the completion of the base case in the BRA (i.e., risk assessment using default and site-specific exposure parameters). It is estimated that it would take approximately six months to conduct a probabilistic risk assessment for OU 10-06. The majority of this time would be spent evaluating software to ensure that the software chosen would interface with fate and transport models presented in Section 4. The need for a probabilistic risk assessment will be determined by the DOE-ID, EPA, and IDHW, and if needed, it will be presented in an additional technical memorandum and not included in the BRA.

3. RISK ASSESSMENT PROTOCOL

Each of the windblown areas and OUs included in OU 10-06 will be evaluated by an individual risk assessment. Cumulative effects from the OUs will not be considered because of the great distance between OUs. Also, 1990 aerial isopleths indicate that there are no cumulative effects between facilities. Therefore, the BRA will consist of 19 or fewer individual BRAs. Areas within facilities are not thought to have cumulative effects, but this will be examined on a case-by-case basis. The appendices will include a partial risk assessment (unique features only) for both a windblown and non-windblown site that will present the general approach to be used for the remaining sites. Unique features are: evaluating background, data interpretation, extent of contamination, land use, exposure scenarios, external air, food, and soil pathways. Section 5 presents the schedule for these appendices.

In addition, at the data quality objective meeting in Seattle, WA, April 26–28, 1994, the use of radionuclide action levels prepared by EG&G Idaho was discussed several times. Although these action levels are not specifically mentioned in this Technical Memorandum, the approach used to generate these levels is similar for all pathways except the external exposure pathway. No actual levels are not used because site-specific data are required for input to RESRAD.

Non-windblown sites, where no additional samples are being collected, will be re-evaluated during the BRA. If any one of the assumptions used in previous risk evaluations are less conservative than OU 10-06 assumptions, then it will be redone.

The following sections further discuss some of these unique features, in addition to how the ecological evaluation will be performed.

3.1 Future Land Use

Overall, the INEL's remote location minimizes the likelihood of significant residential development or other types of development (i.e., commercial or industrial) on or in close proximity to the INEL. The INEL includes portions of Butte, Bingham, Jefferson, Bonneville, and Clark counties. Significant portions of land adjacent to the INEL are federally owned and are, therefore, precluded from private development.

The INEL employed 12,803 contractor and government personnel in January 1992 and is the single largest employer in the region surrounding the site. Despite that fact, the INEL has not generated any significant residential development in close proximity to the Site. Most employees live in the city of Idaho Falls, the closest community providing the necessary amenities to support a population base, including housing, schools, and commercial and industrial services.

Because of the inherent uncertainty of developing long-term land use scenarios, assumptions must be made to provide a basis on which future development patterns can be formulated. Assumptions are thus used for defining intangible factors such as development pressure, advances in research, and land ownership patterns. Assumptions about land use will use the best information available at the time the BRA is being prepared.

Land use assumptions have a significant effect on BRAs for sites contaminated with radionuclides. Cs-137 is expected to be the primary contributor to risk. This assumption is based on the data that have been available to date and on past experience. Direct exposure from Cs-137 (Ba-137m) from surface contamination has consistently been found to contribute at least an order-of-magnitude higher risk than other radionuclides commonly found in surface soils. The land use assumptions are significant in several ways:

- Timing of scenarios is very important to the risk assessment. The half-life of Cs-137 is approximately 30 yr. In one half-life the radioactivity is reduced by half; therefore, in 100 yr the radioactivity of Cs-137 is reduced by approximately an order of magnitude. Land use obviously plays an important role if it is determined that the first probable residential/recreational/agricultural scenario would begin in 100 yr instead of, for example, 10 or 1,000 yr.

- Assumed land use will also restrict the types of scenarios that would be incorporated in a risk assessment. The viability of the residential, agricultural, and recreational scenarios could be limited by the types of land use at any facility area within the INEL.

3.2 Exposure Scenarios and Pathways

Each of the individual risk assessments will address, at a minimum, standard default scenarios (i.e., current occupational and future 30-yr residential), which will be performed for both the OU 10-06, sites and background concentrations of metals and radionuclides. The future residential scenario was added as a bounding scenario, where the receptor is assumed to receive the maximum exposure. An additional future residential scenario may be conducted depending on the location of the individual site and its proposed future land use (see Section 3.1) and on the outcome of the 30-yr future residential scenario. If the 30-yr residential scenario does not show a potential risk, then these additional residential scenarios will not be evaluated. Sites at TAN may have the residential scenario evaluated at 50 yr. Sites at ICPP, TRA, PBF, ANL-W, and the RWMC may have the residential scenario begin at 100 yr. Additionally, other site-specific scenarios based on proposed future land use of the site location will be considered. For example, an agriculture scenario may be evaluated if current land use documents indicate that the facility area is planned to be used for agricultural areas. Both a nonintrusion and intrusion scenario will be used for the residential scenario. In the nonintrusion scenario, the receptor is located at the site boundary, whereas in the intrusion scenario, the receptor is located at the center of the site.

A conceptual site model for the OU 10-06 BRA is presented in the *Final Scope of Work for Operable Unit 10-06 Radionuclide-Contaminated Soils Remedial Investigation/Feasibility Study* (EG&G 1993a). This conceptual site model depicts the exposure pathways to be evaluated based on the depth of contamination. It should be noted that exposure pathways are also CoPC-dependent (e.g., external exposure pathway is applicable only for radioactive CoPCs).

3.3 Toxicity Assessment

The objectives of the toxicity assessment are to evaluate the inherent toxicity of the compounds under investigation and identify and select toxicological measures to use in evaluating the significance of exposure. In the windblown areas, radionuclides are the contaminants of concern. Slope factors for radionuclides will be obtained from the EPA's *Health Effects Assessment Summary Tables* (HEAST) (EPA 1993b). Slope factors are available for inhalation, ingestion, and external exposure. Using slope factors is the conventional method used by the EPA for calculating risk from a soil concentration.

However, the external exposure slope factors presented in the HEAST (EPA 1993b) (in units of risk/yr per pCi/g soil) are based on the assumption that they are uniformly distributed in a thick layer of soil. For the windblown sites at OU 10-06 where there is lightly contaminated soil distributed only in the top few centimeters, the use of these slope factors is inappropriate. The EPA[a] states that, in this instance, the preferred method is to measure the radiation field at one meter above ground surface (uR/hr) and convert to risk, using the NRC's risk values of 5E-04 risk of fatal cancers/rem for residential exposures and 4E-04 risk of fatal cancers/rem for occupational exposures (10 CFR 20). The "R" stands for a roentgen, which is the amount of energy deposited in air. To convert this value to a rem (i.e., roentgen equivalent man, or biological dose), it must first be converted to a rad (i.e., radiation absorbed dose), which is approximately equivalent to a roentgen. To convert from a rad to a rem, the number of rads is multiplied by a quality factor. A quality factor takes into consideration the differing amounts of damage caused by various forms of ionizing radiation. For gamma radiation, the quality factor is one. The time factors that will be used for this conversion will be the EPA standard default values for both the occupational and residential exposure scenarios (e.g., 8 hr/day, 250 days/yr, 25 yr).

The approach for collecting field dose readings is presented in a Document Revision Request (DRR No. ER-1167) to the *Sampling and Analysis Plan for Phase II of the Operable Unit 10-06 Radionuclide-Contaminated Soils Remedial Investigation/feasibility Study* (EG&G 1994b). In summary, these field dose measurements are being collected at all Phase I and II sampling locations and select RESL sample locations. In addition, to provide more information on the distribution of the radionuclides away from the source area (i.e., a facility), field dose measurements are being collected at approximately 15-m intervals along the transects of each windblown site. The field dose measurements are collected at waist-high levels (1 m) to assess the realistic exposure and potential dose to someone standing on the site. Analytical data from the soil samples will be used to determine the specific isotopes contributing to the radiation field and their ratios for use in other exposure pathways (e.g., inhalation and soil ingestion). If possible, the field dose readings will be correlated with the isotopic analytical results. Appendices B and C will include an evaluation of the external exposure pathway using this approach.

For non-windblown sites, where the radionuclide-contaminated soil exists at depth, EPA slope factors will be used. The external exposure pathway will be evaluated at these sites by using RESRAD in conjunction with EPA slope factors.

Toxicity information of nonradioactive contaminants detected in any of the sites will be obtained either from the *Integrated Risk Information System* on-line data base (EPA 1994) or the

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a. Private communication between Robert L. Nitschke, EG&G Idaho, and Chris Nelson, EPA-Headquarters, November 1993.

HEAST (EPA 1993a). The health effects that result from each detected radionuclide and its daughter products from November 1, 1994, through 1,000 yr will be evaluated.

3.4 Ecological Evaluation

For the purpose of the BRA, the ecological evaluation will consist of a qualitative discussion on any potentially adverse ecological impacts from the various sites and associated CoPCs. The quantitative analysis of the CoPCs (both radioactive and nonradioactive) is deferred to the screening level ecological risk assessments (ERAs) that are being performed as part of the INEL site-wide ecological risk assessment. As part of that task, a manual was developed that provided site-specific guidance for performing a screening level ecological risk assessment for each waste area group at the INEL. The ERA process evaluates the likelihood that undesirable ecological effects may occur or are occurring as a result of exposure to one or more stressors (where "stressor" refers to any physical, chemical, or biological entity that can induce an adverse effect) (EPA 1992a). Screening-level ERAs use existing information and data to screen contaminated areas by identifying the sites that pose a risk to the ecological components at the area. The methodology presented in the manual will allow the screening of contaminated sites at OU 10-06 as part of Waste Area Group 10 screening-level ecological risk assessment, using the data available from the Phase I and Phase II sampling. In addition, it may be possible to compare screening levels calculated at other sites to concentrations of compounds defected at OU 10-06 to determine if there is a potential for adverse effects to the environment.

4. MODEL SELECTION

Models to be used for determining transport of chemicals or radionuclides in the air and to groundwater are presented below.

4.1 Data Interpolation

Concentrations at sites with windblown soil contamination will be estimated using a variety of statistical and geostatistical tools. The spatial characterization of windblown contamination will be evaluated using GEO-EAS. GEO-EAS computes a number of spatial data descriptors and will provide the kriging analysis. Kriging is a method of interpolating contaminant concentrations over the site of interest. The GEO-EAS code is implemented in the PC-environment and is available from the EPA (EPA 1988).

4.2 Air, Food, and Soil Pathways

Potential exposure to future residents and workers from inhalation and food and soil ingestion will be evaluated by RESRAD. RESRAD is a model developed in research work sponsored by the DOE and evaluates several exposure pathways from a radionuclide-contaminated soil source. RESRAD determines dose as a function of exposure time for a radionuclide and its decay products. The RESRAD code can be implemented on an IBM PC and is available from the Argonne National Laboratory-East (ANL 1989).

No air dispersion modeling will be performed for the windblown sites because the Phase I analytical results for soil samples collected along the transects indicate that the concentration of the Cs-137 decreases with increased distance from the facility. This data indicate that radionuclide deposition has primarily been the result of initial release and wind dispersion and resuspension of soil particles has not been a major factor in contributing to the current pattern of contamination. However, in order to evaluate the inhalation pathway all contaminants will be modeled to the receptor location using a mass loading approach in the RESRAD code. Estimates of the respirable amount of material will be obtained from measured data and other analytical models.

4.3 Groundwater Pathway

The groundwater pathway will be considered for those sites with a potential for the contaminants to migrate through the subsurface to the groundwater. These sites include:

- OU 1-04 TSF Acid Pond (TSF-29)
- OU 1-05 TAN/TSF-1 Area (Soil Area) (TSF-06)
- OU 5-09 PBF Special Power Excursion Reactor Test IV Leach Pond (PBF-22)
- OU 6-02 BORAX II-V Leach Pond (BORAX-01)

- OU 6-02 BORAX Ditch (BORAX-08)
- OU 6-04 Radioactive Soil Contamination at EBR-I (EBR-15)
- ANL-W stockpile of radionuclide-contaminated soil from the interceptor canal
- OU 10-01 LCCDA (LCCDA-01 and LCCDA-02).

The other sites will not evaluate the groundwater pathways because they are only suspected of having surface contamination, lack of a driving force and long travel-time to the aquifer, and minimal contamination. Concentrations of the CoPCs in the groundwater and their associated risk will be modeled for 1,000 yr from September 30, 1994.

Potential exposure to a future residential population from the ingestion of groundwater will be evaluated with the semi-analytical model GWSCREEN (EG&G Idaho 1992a). This model assesses the groundwater pathway from the leaching of radioactive and nonradioactive contaminants from surface or buried sources to groundwater.

The computer model GWSCREEN was developed for assessing and screening the groundwater pathway for the implementation of Track 1 and Track 2 assessments of low probability hazard sites at the INEL. The results from the model are semi-quantitative with the resultant groundwater concentration being estimated using a mass conservation approach. The complete description for the code can be found in *GWSCREEN: A Semi-Analytical Model for Assessment of the Ground Water Pathway from Surface or Buried Contamination: Version 2.0 Theory and User's Manual* (EG&G 1992a).

GWSCREEN simulations require input parameter estimates of the contaminated source volume and the total curies of each radionuclide and total mass of chemical contaminants. The contaminated source volumes are estimated as rectangular prisms that include all subsurface radionuclides. For the GWSCREEN simulations, all contaminants will be conservatively assumed to be uniformly mixed in the contaminated source volume.

5. SCHEDULE OF OU 10-06 BRA AND SITE-WIDE ECOLOGICAL RISK ASSESSMENT

The schedules for the OU 10-06 BRA and site-wide ecological risk assessment are presented below in Table 6 and in a time-line format in Figure 3. The date for having a completed screening level guidance for ecological risk assessments at the INEL is May 25, 1994. This screening level guidance provides the approach that will be used in the actual screening of data for the ecological risk assessment and because the ERA after the collection of data for use in the OU 10-06 BRA, it was not possible to coordinate the OU 10-06 sampling programs with the ecological risk assessment.

Table 6. Schedule of deliverables for BRA Technical Memorandum and appendices.

Deliverable	Date
Draft BRA Technical Memorandum to agencies (i.e., DOE-ID, EPA, and IDHW) for review	May 25, 1994
Transmit Draft Ecological Screening Level Manual to DOE-ID	May 25, 1994
Conference call with agencies to discuss their comments to EG&G Idaho on the Technical Memorandum	June 17, 1994
Appendix A—Background submitted to agencies	July 6, 1994
Verbal comments from agencies to EG&G Idaho on Background Appendix (Appendix A) at the scheduled conference call	July 20, 1994
Appendix B—Windblown Site, LOFT (unique features only) submitted to agencies	July 20, 1994
Transmit draft INEL-waste area group wide ecological risk assessment screening levels to DOE-ID	August 1, 1994
Verbal comments from agencies to EG&G Idaho on Windblown Site Appendix (Appendix B) at the scheduled conference call	August 3, 1994
Appendix C—Nonwindblown site, ANL-W (unique features only) submitted to agencies	August 3, 1994
Verbal comments from agencies to EG&G Idaho on Nonwindblown Site Appendix (Appendix C) at the scheduled conference call	August 17, 1994

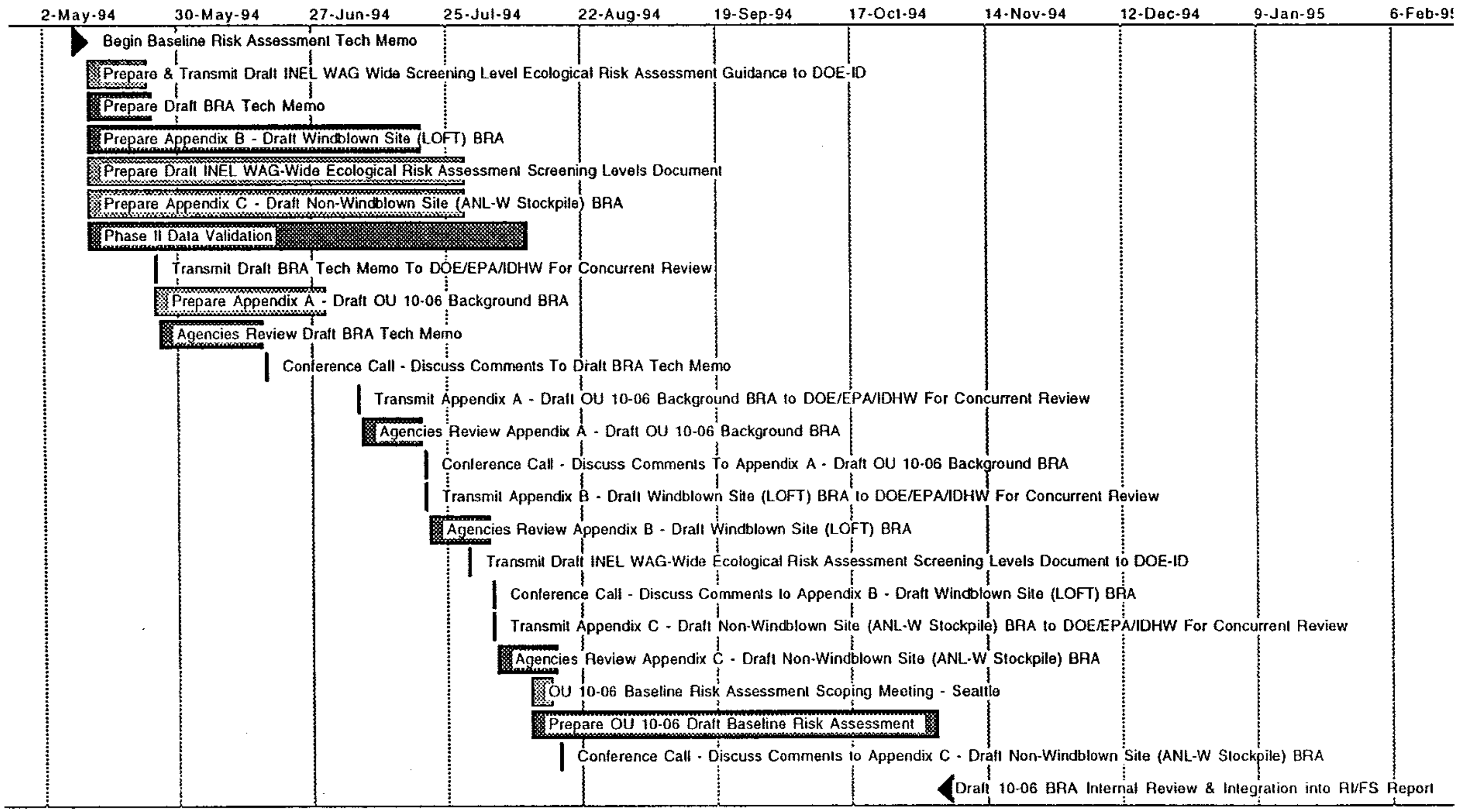

Figure 3. Schedule of OU 10-06 BRA and site-wide ecological risk assessment.

6. SUMMARY

As required under the National Oil and Hazardous Substance Contingency Plan, the OU 10-06 BRA will address potential risks to human health and the environment form past releases. The purpose of this technical memorandum for OU 10-06 BRA is twofold. The first is to document the consensus reached pertaining to aspects of the BRA that are specific to OU 10-06 and uniquely applicable to calculating human health and the environment as a result of the contaminants at OU 10-06 and the second is to present all of the information available to date on conducting the BRA. The BRA will be included in the remedial investigation report and will provide essential information for the Remedial Project Manager's decision-making process.

This Technical Memorandum has been organized in such a manner as to follow the process for conducting a BRA as outlined in the *Risk Assessment Guidance for Superfund: Volume 1 - Human health Evaluation Manual* (EPA 1989). First brief summaries of the existing data and the OU 10-06 data collection programs were presented. The approach for determining background concentrations of the data to collected to date was presented. Next, the data evaluation and usability section presents the various types of quality indicators that all the data (both background and site-specific) are evaluated against. Once the data have been determined to be acceptable for use in the BRA, then the concentration term is calculated. The first step in calculating a concentration term is to screen out compounds that are within the range of background and those that under conservative assumptions do not present a risk to human health. Screening approaches are designed to focus BRAs to the actual CoPCs that potentially present a risk to human health. The extent of contamination will be determined using kriging for windblown sites and a qualitative uncertainty analysis will be presented in the BRA.

The concentration term is used as the input into the exposure assessment section of the BRA. This assessment, combined with the toxicity assessment represents the risk characterization portion of the BRA. As discussed in this Technical Memorandum, the external exposure will be evaluated differently than the approach presented in EPA (1989) because of the surficial deposition of the contaminants for the windblown sites. The exposure scenarios to be evaluated include both intrusion and nonintrusion future residential and a current occupational.

The models selected for this BRA have either been developed by the EPA or their use has been accepted by the EPA by their acceptance of other risk assessments using them. Finally, the schedule for the waste area group 10-wide ERA and the OU 10-06 BRA are such that they did not allow for coordination of the OU 10-06 sampling program with the ERA.

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